CLAIMS:

1. A noise cancellation circuit for a communications channel comprising a differential signal path and a common mode signal path connected to respective inputs of a summing device, the differential signal path comprising input means connected to the channel for receiving a differential signal therefrom and supplying the differential signal to a first of the inputs of the summing device, the common mode signal path comprising extraction means coupled to the channel for extracting therefrom a common mode signal, and coupling means for coupling at least part of the extracted common mode signal to a second of the inputs of the summing device as a common mode noise estimate signal, the coupling means having a capacitive component equivalent to stray capacitance coupling between an input and an output, respectively, of the input means, the circuit further comprising means for compensating for phase differences between the differential signal and common mode noise estimate signal before their application to the summing device, the summing device providing as an output signal of the noise cancellation circuit the difference between the differential signal and the common mode noise estimate signal.

2. A noise cancellation circuit for a communications channel comprising a differential signal path and a common mode signal path connected to respective inputs of a digital adder, the differential signal path comprising input means connected to the channel for receiving a differential signal therefrom and analog-to-digital converter means coupled to the input means for digitizing the received differential signal and applying the digitized differential signal to a first of the inputs of the digital adder, the common mode signal path comprising extraction means coupled to the channel for extracting therefrom a common mode signal, a second analog-to-digital converter means coupled to the extraction means for digitizing the extracted common mode signal and applying the digitized extracted common mode signal to a noise detector for detecting one or more noisy frequency bands of the common mode signal and passing the digitized common mode signal in those detected frequency bands to an adaptive filter, the adaptive filter filtering the digitized common mode signal to produce a digital common mode noise estimate signal and applying the digital estimate signal to the second input of the digital adder, control means having inputs connected to the differential signal path and

the common mode signal path and for determining correlation between signals in the differential signal path and common mode signal path and adjusting coefficients of the adaptive filter in dependence thereupon so as to reduce correlation between the differential and common mode signals, the circuit further comprising means for compensating for phase differences between the differential signal and the common mode signal before their application to the digital adder, the adder providing as an output signal of the noise cancellation circuit the difference between the differential signal and the digital common mode noise estimate signal.

3. A noise cancellation circuit for a communications channel comprises a differential signal path and a first common mode signal path connected to respective inputs of a summing device, the differential signal path comprising input means connected to the channel for receiving a differential signal therefrom and supplying same to a first of the inputs of the summing device, the first common mode signal path comprising extraction means coupled to the channel for extracting therefrom a common mode signal and coupling means connected between the common mode extraction means and a second input of the summing means for coupling an analog common mode noise estimate signal to the summing means, the coupling means having a capacitive component equivalent to stray capacitance coupling between the input and the output, respectively, of the input means, and first compensating means for compensating for phase differences between the differential signal and analog common mode noise estimate signal before their application to the summing device, the output of the summing device being connected by way of an analog-to-digital converter to a first input of a digital adder means, the circuit further comprising a second common mode signal path connected between the common mode signal extraction means and a second input of the digital adder, the second common mode signal path comprising a noise detector connected by way of an analog-to-digital converter to the output of the common mode extraction means, the noise detector being operable to detect one or more noisy frequency bands of a digitized common mode signal from the analog-to-digital converter means and pass the digitized common mode signal in those detected frequency bands to an adaptive filter, the output of the adaptive filter comprising a digital common mode noise estimate signal and being applied to a second input of the digital adder means, the circuit comprising control means connected to the differential signal path and the digital common mode signal path for determining

correlation between signals in the differential signal path and digital common mode signal path, respectively, and adjusting coefficients of the adaptive filter in dependence thereupon so as to reduce correlation between said signals, the circuit further comprising second compensating means for compensating for phase differences between the signal output from the first summing means and the digital common mode noise estimate signal before their application to the respective inputs of the digital adder means, the digital adder means providing as an output signal of the noise cancellation circuit the difference between the differential signal and the two common mode noise estimate signals.

4. A noise cancellation circuit according to claim 1, wherein the first compensating means comprises an analog delay unit interposed between the input means and the summing device and having a delay period substantially equal to delay introduced in the analog common mode signal path.

5. A noise cancellation circuit according to claim 3, wherein the first compensating means comprises an analog delay unit interposed between the input means and the summing device and having a delay period substantially equal to delay introduced in the analog common mode signal path.

6. A noise cancellation circuit according to claim 1, wherein the input means comprises a hybrid transformer and the coupling means comprises a second hybrid transformer similar to the first hybrid transformer, the primary winding of the second hybrid transformer being short-circuited and connected to the output of the common mode signal extraction means for reception of the common mode signal and the secondary winding of the second transformer being connected to said second input of the summing device.

7. A noise cancellation circuit according to claim 3, wherein the input means comprises a hybrid transformer and the coupling means comprises a second hybrid transformer similar to the first hybrid transformer, the primary winding of the second hybrid transformer being short-circuited and connected to the output of the common mode signal extraction means for reception of the common mode signal and the

secondary winding of the second transformer being connected to said second input of the summing device.

8. A method of cancelling common mode noise in signals received from a communications channel using a noise cancellation circuit having input means connected to the channel, comprising the steps of:

extracting via the input means from the channel a differential signal;

extracting from the channel a common mode signal;

passing at least part of the extracted common mode signal through a coupling device having a capacitive component equivalent to stray capacitance coupling between an input and an output, respectively, of the input means,

compensating for phase differences between the differential signal and common mode noise estimate signal and obtaining the difference between the differential signal and the common mode noise estimate signal.

9. A method of cancelling common mode noise in signals received from a communications channel using a noise cancellation circuit having input means connected to the channel, the method comprising the steps of:

extracting from the channel via the input means a differential signal and a common mode signal and digitizing same;

using a digital noise detector, detecting in the digitized extracted common mode signal one or more noisy frequency bands of the common mode signal;

passing the digitized common mode signal in those detected frequency bands through an adaptive filter to produce a digital common mode noise estimate signal;

determining correlation between the differential signal and common mode signal and adjusting coefficients of the adaptive filter in dependence thereupon so as to reduce correlation between the differential and common mode signals,

compensating for phase differences between the differential signal and the digital common mode noise estimate signal before combining the digitized differential signal and the digital noise estimate signal subtractively to provide an output signal.

10. A method of cancelling noise in signals received from a communications channel using a noise cancellation circuit having input means connected to the channel, the method comprising the steps of:

extracting via the input means from the channel a differential signal;

extracting from the channel a common mode signal;

passing at least part of the extracted common mode signal through a coupling device having a capacitive component equivalent to stray capacitance coupling between an input and an output, respectively, of the input means,

compensating for phase differences between the differential signal and common mode noise estimate signal and obtaining the difference between the differential signal and the common mode noise estimate signal; and

extracting from the channel via the input means a differential signal and a common mode signal and digitizing same;

using a digital noise detector, detecting in the digitized extracted common mode signal one or more noisy frequency bands of the common mode signal;

passing the digitized common mode signal in those detected frequency bands through an adaptive filter to produce a digital common mode noise estimate signal;

determining correlation between the differential signal and common mode signal and adjusting coefficients of the adaptive filter in dependence thereupon so as to reduce correlation between the differential and common mode signals,

compensating for phase differences between the differential signal and the digital common mode noise estimate signal before combining the digitized differential signal and the digital noise estimate signal subtractively to provide an output signal.

11. A noise cancellation method according to claim 8, wherein the compensation is provided by delaying the differential signal by a delay period substantially equal to delay incurred by the analog common mode signal during extraction and noise detection.

12. A noise cancellation method according to claim 10, wherein the compensation is provided by delaying the differential signal by a delay period substantially equal to delay incurred by the analog common mode signal during extraction and noise detection.

13. A noise cancellation method according to claim 8, wherein the input means comprises a hybrid transformer and the coupling is achieved using a second hybrid transformer similar to the first hybrid transformer, the primary winding of the second hybrid transformer being short-circuited and connected for reception of the common mode signal and the secondary winding of the second transformer providing the common mode signal.

14. A noise cancellation method according to claim 10, wherein the input means comprises a hybrid transformer and the coupling is achieved using a second hybrid transformer similar to the first hybrid transformer, the primary winding of the second hybrid transformer being short-circuited and connected for reception of the common mode signal and the secondary winding of the second transformer providing the common mode signal.